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THE DEVELOPMENT OF A REENTRY
PROGRAM FOR WOMEN IN ENGINEERING
AT THE UNIVERSITY OF CENTRAL FLORIDA

BY

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A.B., Randolph-Macon Woman's College, 1959

RESEARCH REPORT

Submitted in partial fulfillment of the requirements
for the degree of Master of Science
in the Graduate Studies Program of the College of Engineering
University of Central Florida
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ABSTRACT

In order to familiarize local women with advanced degree possibilities in engineering and with expanding local industry, as well as increasing the graduate enrollment in the College of Engineering, the University of Central Florida has developed a Reentry Program for Women in the Industrial Engineering Department. Master of Science degrees are offered to the women with four options: Operations Research, Computer Systems, Engineering Administration, and Engineering Systems Analysis.

The program is designed for women who received a bachelor's degree at least two years ago in mathematics, engineering, physics, or another hard science. Seed money for the program was obtained as a mini-grant from the Women's Reentry Consortium. The major component of the program is a mathematics review course which offers an intensive review of college math through differential equations.

An Industrial Advisory Board is an integral part of the program and is giving support for potential employment of women during their schooling and afterwards, as well as making sure the women are going in directions consistent with the needs of industry.

A special orientation, available tutoring, and a Professional Development Day are some of the features incorporated in this program. After the math review course, the women are mainstreamed into the standard graduate program with continued support.

ACKNOWLEDGEMENTS

Sincere gratitude to all the IEMS/EMCS faculty, the secretaries and student assistants in Room 410, and especially Dr. Gary E. Whitehouse, who listened.

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CHAPTER I

INTRODUCTION

During the past few years, women have been returning to school in increasing numbers. In order to familiarize more of these women with the advanced degree possibilities in engineering, the University of Central Florida set up the Reentry Program for Women in September 1981. Besides encouraging women into the non-traditional career path of engineering, the program is designed to familiarize women with the growing technological manpower needs in Central Florida, and to increase the enrollment at the graduate level in the College of Engineering.

Much has been written on women and the labor force, but less research has been done on the educational needs women experience (Lantz, 3). Even less has been written on women preparing to enter the engineering field after retraining at the graduate level. The purpose of this paper is to serve as a historical document for this innovative program's first year and make recommendations for the future of the Reentry Program for Women.

CHAPTER II

BACKGROUND FOR REENTRY PROGRAM FOR WOMEN

Reentry to what? Reentry in this context means returning to the academic world after a period of absence. The secondary definition may also be returning to the labor force. Why just women? The reason this program was initially started for just women is that the "seed money" for the project came from a grant which specified women.

The background of this grant began in the 1960's when the National Science Foundation (NSF) addressed the problem of the country's increasing need of people with technical training. Use needed to be made of every available resource and a generally untapped resource is women who have been trained in science or engineering and dropped out of the job market for a variety of reasons.

Figure 1 shows that in a study by the Scientific Manpower Commission in the time period of 1948-1980, more than 1,400,000 women have earned bachelor's degrees in science and engineering. Of these, only an estimated 300,000 are employed as scientists or engineers. Approximately 32,000 women are not seeking employment, which leaves over 1,000,000 women with adequate mathematics backgrounds who could possibly be interested in being retrained (Reentry, 1982).

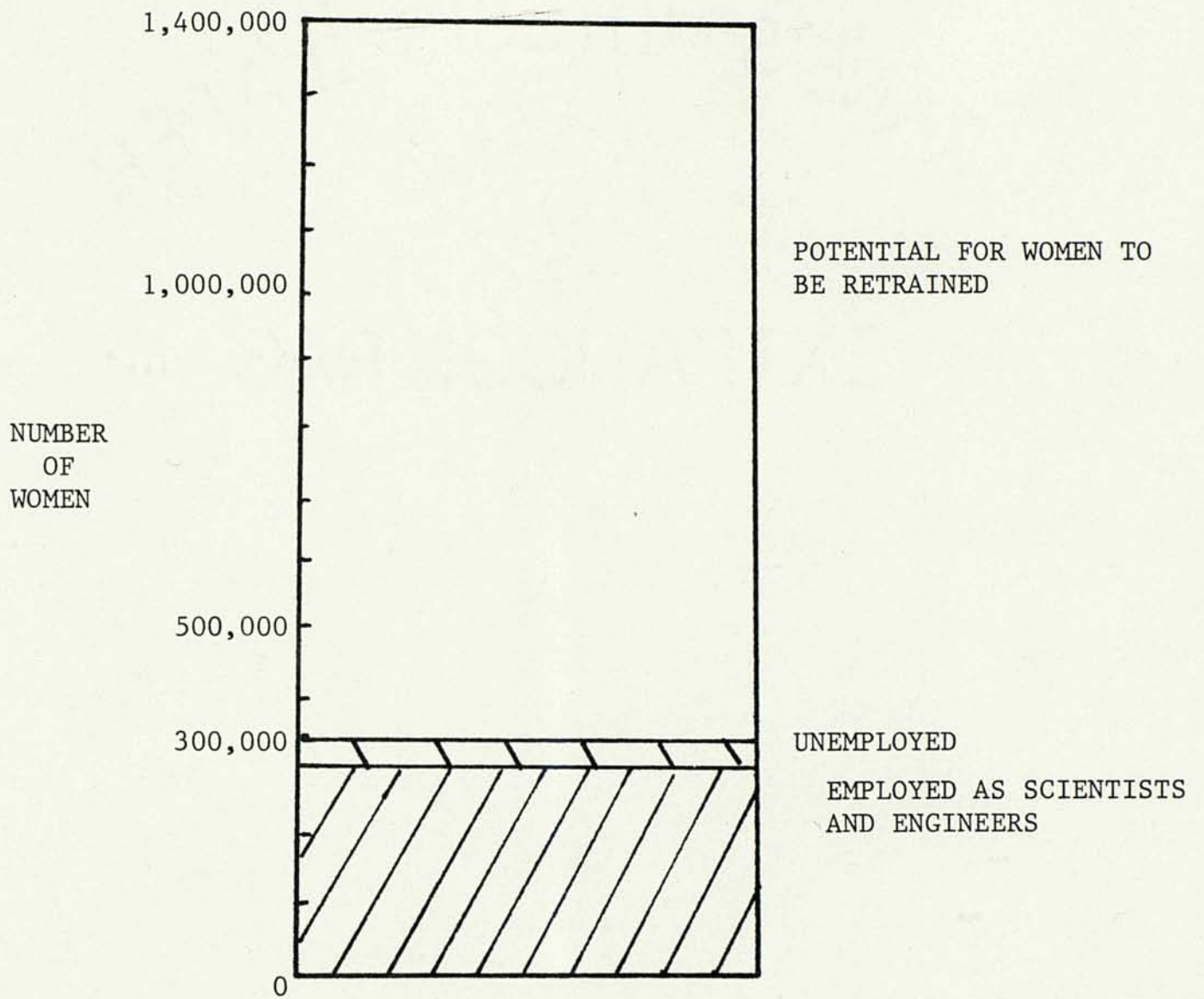


Figure 1. Status of women earning bachelor's degrees in science or engineering, 1948-1980.

Beginning in the fiscal year 1976, the interest for women-in-science programs was matched with congressional authorization of one million dollars for the activities. A plan was developed by NSF to target three audiences: college or university students, women with degrees in science and currently not in science, and high school students. Two main types of projects emerged from this plan: Science Career Workshops and Science Facilitation Programs. In the first category, ninety-nine grants were made in the fiscal years 1976 through 1979.

One of these workshops was held at the University of Central Florida (UCF) in the fall of 1979, under the direction of Dr. Marilyn Whisler of the Political Science Department. The purpose of this day-long workshop was to expose college women to the variety of careers in all sciences and introduce them to a variety of role models. This successful day was entirely funded by NSF.

In the same time period, thirty-three grants were made for Career Facilitation Projects which were designed for women with degrees in science to enter or reenter science. These programs were designed for the woman with a scientific background who was underemployed or unemployed in the sciences. The project consisted of specially designed full-time courses for the most part with the grant paying all the costs (Shaw, 1980).

The University of Dayton received one of these grants and developed a Fast Track program. This was a full-time, twelve-month program with specially designed curriculum in chemical engineering

and electrical engineering and a certificate offered when finished. Since all expenses were paid by the grant, many of the women relocated to participate in the program. Other programs at different schools were in computer science, polymer science, and industrial chemistry (Vetter, 1980).

In 1980, three schools that had had successful career facilitation programs formed the Women's Reentry Consortium in order to share their special knowledge with others and focus on reentry programs in the baccalaureate and post-baccalaureate area. With funding obtained through NSF and the Fund for Improvement of Post-Secondary Education (FIPSE), they held three regional seminars in Spring 1981 entitled "Developing and Funding Programs for Women". The seminars were designed to help other institutions develop plans to start their own programs similar to the original Career Facilitation Programs.

Following the regional seminars, which more than one-hundred schools attended, participants could compete for mini-grants called reentry incentive awards.

Since there were five "reentry type" women already enrolled in the graduate program in the Industrial Engineering and Management Systems Department (IEMS) and Engineering Mathematics and Computer Systems Program (EMCS) at UCF, Dr. Gary E. Whitehouse, Department Chairman, attended one of these seminars.

The call for proposals following the seminar had as its guidelines "to encourage the development and implementation of projects

designed to facilitate the reentry of women into professional careers and/or academic programs leading to such careers". The mini-grant was to provide "seed money" for the project.

The objective of the UCF proposal was "to encourage women with bachelor's degrees in engineering, math, or hard sciences to enter graduate school in engineering". Our need was "to aid in reorienting women to an academic environment".

The primary component of the program was a math review course which would review all college calculus and differential equations before entering the graduate courses. The math review course was modeled after one offered in the past for displaced aerospace engineers being retrained as environmental engineers.

Another component of the program was the coordinator. This person interviewed all the women on the phone or in person, answered questions, and hopefully served as a role model for the women. The coordinator also organized special days as Orientation and Professional Development Day, planned special interest seminars, wrote newsletters to all participating women, advised the women, helped in registration, and assisted them in ways necessary for someone new on campus.

The announcement of the University of Central Florida receiving the grant came in August and the Women's Reentry Program was underway. Sixteen other colleges received the "mini-grants" at that time. The other winners and their field of interest are listed in Appendix A (Reentry, 1981).

CHAPTER III

ORGANIZING REENTRY PROGRAM FOR WOMEN

With the grant in hand, the objectives and strategies of the program needed to be worked out. This program was to be designed to encourage women to enter graduate school in the engineering field. Master of Science (M.S.) degrees would be given by the IEMS Department and the EMCS Program, since the project had been initiated in that department. The degree options include Operations Research, Engineering Administration, Computer Systems, and Engineering Systems Analysis.

At this time, the general strategies included plans on deciding on the type of woman to be recruited, selection of a total calculus review book, designing the math review course, designing a brochure, forming an Industrial Advisory Board, designing and printing an application, surveying the way women's needs were met on the UCF campus, and different types of publicity possibilities.

The type of woman who would be interested in updating herself with a Master of Science degree was the first strategy addressed. According to the existing literature, most of the women entering a program such as this would be homemakers coming out of the home after their children were grown or in school (Chitayat, 1980). Thus, the publicity would be geared to this type of woman.

In the fall, contacts with women who had been active in women's work throughout the University and the Orlando area were made and names of people and organizations were obtained and the whole project was discussed. In one of these discussions, it was decided that since most of these women would be coming out of the home, they would be interested in a short snappy course that would be given while the children were still in school in the spring. Thus, a summer session of six weeks beginning May 10 was decided on with eight hours per week of class, and Dr. Harold Klee would be the instructor.

At the same time, a book for the math review course needed to be obtained. After much research, one book reviewing all calculus was found - Analytic Geometry and Calculus by Bernard J. Rice and Jerry D. Strange of the University of Dayton. The authors said it could be taught in a short time period, since a prerequisite of the course was that all calculus courses had to have been taken sometime in the past.

Next, came the brochure. The decision was made to have the brochure different from the rest of the engineering brochures, although still the same size, since the grant would be paying for it and it could be printed off campus. At that time, there was not a general write-up of the four options available, and since this was to be included in the brochure, it had to be done first.

The options are as follows:

1. Industrial Engineering and Management Systems Department

a. Engineering Administration - The Engineering Administration option provides for the opportunity for in-depth study of new technical developments in the College of Engineering, augmented by study of new administrative and management concepts in the College of Business Administration. The basic program is designed for persons with technical backgrounds who are seeking to advance into management in a technically oriented firm. This option prepares the student with the basic techniques required to manage people, develop the ability to use analytical tools, and apply decision-making techniques to technical and business problems.

b. Operations Research - Operations Research is the application of computer and quantitative models to the decision problems of business which include hospitals, banking and social services. The role of Operations Research is to help management find the overall optimum solution for problems involving interactions of objectives. Operations Research tries to find the best decisions relative to a portion of the total system as possible.

2. Engineering Mathematics and Computer Systems Program

a. Engineering Systems Analysis - In a society which is producing more people, more materials, more information than ever before, the analysis of complex systems and equipment

requires talented individuals who are especially trained in the application of mathematics and the use of computer systems. Some of the tools of Systems Analysis are modeling, optimization, control, computing, and reliability; they are available to solve the engineering and scientific problems of today in a systematic approach. Virtually all disciplines are amenable to the Systems Engineer, ranging from the dynamics of reentry vehicle guidance systems to the response of local health care systems.

b. Computer Systems - In contemporary professional engineering practice and in manufacturing research and development activities, there is an increasing need for engineers and technical support staff with training and capability in the application of mathematics and computers to the modeling simulation and solution of complex technical problems. This option provides the student with an appropriate educational experience to facilitate employment in a wide variety of computer-related fields. Course coverage includes computer hardware, software engineering, and microcomputers. Depending on the student's interests, computer graphics or other similar advanced areas are available as technical electives.

By the time the entire brochure was organized and to the printer, so much time had passed that the date to begin publicity was moved to the first week in January. For a fascimile of the brochure, see Appendix B.

At the same time, the concept of the Industrial Advisory Board was being developed. One reason for the advisory board was to throw the entire concept out to them before informing the community. What would be the response to this program?

Using names obtained from people within the University, a group of people from different industries was called. Purposefully, personnel departments were not called, but people who would actually be working with the women. The immediate response of everyone called was so positive that an Industrial Advisory Board was quickly drawn up with people from the community and University. Appendix C lists the participants.

At the first meeting with the board in November, not only were they familiarized with the program, but some had never been to UCF. The main difficulty in preparing for the meeting was to give them some direct purpose rather than just be a sounding board. The purpose given them was to give input to the reentry program, publicize the program in their company, and possibly some monetary help in way of scholarships and internships.

A publicity campaign was planned for the first weeks of January, although this would allow only three months of publicity before registration, rather than the recommended six months (Vetter, 1980).

Bill Daum, Public Affairs, helped by agreeing to send out the news releases during that time. We also wanted radio and television coverage. On the first call in that field, Carol Nelson

agreed to an interview on the Noon Day News on Channel 9 at the end of December.

The appearance on the noon news came at a time when the University was shut for the holidays and people had to hold on to the phone number for an extra week. When the University first reopened, the phone started ringing and women wanted information. Immediately, a description of the course of study options (see Appendix D), the brochure, and a specially designed application (see Appendix E) for the Reentry Program were sent out. The applications had been designed to give the coordinator a direct contact with the potential students.

At the same time, brochures were sent to all women who had graduated from UCF in the hard sciences and various companies that were in the area with an engineering interest. By the end of January, essentially all publicity had been done. The response was slow and steady. Some women were qualified, some were not.

The brochures sent to the various small companies seemed to have no response, brochures to graduates also had a small response. The major single response came following the Carol Nelson interview. No publicity that was placed specifically for the volunteer obtained any results. The newspaper articles generated some interest. The goal of having fifteen qualified women in the class was soon reached.

Then in March, The Orlando Sentinel had a career opportunities section which gave a large write-up of our reentry program. The

next week, over fifty women called wanting more information. Thus, to all of these the packet was sent and they were all interviewed either over the phone or in the office. Suddenly, the program seemed to have the possibility of getting out of hand. Although many of the women were not qualified, many were. In looking at the type of women applying, it seemed they all were redirecting a career they were already in or changing jobs. In short, they were not coming out of the home.

A decision had to be made about the course. These women could not be working full-time and take eight hours of calculus review a week. Women were coming from different backgrounds than originally planned for, and the course had to be changed to the twelve-week summer session meeting only four hours per week, with an hour of supervised homework time with a special tutor before each two-hour class.

Since the students were working women with families, a flexibility had to be set into the program. The classes were offered live at night rather than during the day, as originally planned. They were also taped for showing during the day at a scheduled time and the students could also see them at the library at a later time.

An orientation was held the Friday evening of the registration time for the women. This was held in the industrial engineering laboratory. After a tour of the lab, the orientation was held.

Dr. Whitehouse spoke briefly on the program and Dr. Klee spoke on the math review class. After that, the various student services were explained by Dr. Carol Wilson, Associate Dean of Students, and Mrs. Mary Alice Hartman, Coordinator - Skills Center.

The women were then all shown how to fill out the trial and advisement card and told how to register. The group was allowed to register at one time since the crowd was not too large at that time.

Twenty-nine people originally registered for the course. This included two men returning to school, and four women who eventually dropped the course because of their business load. Three of these four are planning to continue in the program, however.

The remaining twenty-five people who began the course finished it and are planning to continue work on their master's degrees. Most will be part-time, at least until they are further into the graduate program; six are full-time.

Most of the women were advised by the coordinator for their fall program since they were getting their prerequisites out of the way. They are all taking courses in the mainstream as each has her own set of requirements based on her background and which option she plans to follow. Support for the women has continued even though they have been mainstreamed. Lunches with some of the professors and administrative staff are held weekly. A series of dinner seminars is planned to include assertiveness training, time management, and the communication skills of speaking and listening.

CHAPTER IV

APPLICANTS FOR REENTRY PROGRAM

When asked to name one positive aspect of themselves, almost all the reentry women said, "the guts to come back to school". Most of the women in the program are back for the first time since their bachelor's degrees. They have the same characteristics as other women who have reentered school after a period of time. They are unsure of themselves and need to have more reassurance than the typical student. Once they commit themselves to the project, they work at it to do the best they can.

Several types of women replied to the publicity in the media. Mostly they had math or chemistry backgrounds and were interested in a new career. Others replied since the word engineer has some magic to it in this tight employment situation. Some wanted a job immediately at the university.

Of the women who really wanted to get a Master of Science degree, the ones with no calculus were discouraged. Many of these women are currently taking their calculus and differential equations in order to apply at a later date.

Some of the women in the group applying had no differential equations. These were let into the math review course along with the women fully qualified and the course was used to prepare them

for differential equations, which they will take as soon as possible.

A decision was made to keep the women at post-baccalaureate status until all their math requirements were met. They could be completing other prerequisites and taking up to 9 hours of graduate work while remaining in this status. Another requirement, because of University regulations, was to take the Graduate Record Examination. This was recommended as one of the first steps in their procedure of applying.

The women in the math review class were given a questionnaire during the first half of the course to which nineteen replied. For an example of the results of the questionnaire, see Appendix F.

Counter to preconceived thoughts of the women in the reentry process, none of the women answering the questionnaire were divorced. Fifteen were married. The main age groups were in the twenties and thirties, with an average age of thirty-two. Six of the married women had husbands that were engineers. The children were spread in ages.

Although the brochure says only women with a degree in a hard science are eligible, there are women in the program with degrees in English, education, and general studies. These women, for the most part, have been taking courses on the side since their degrees, or had begun college in one of the sciences and had switched into a non-technical degree, since women at that

time were not encouraged to continue in their pursuit of a scientific career.

Three of the women have master's degrees already. They are in chemistry, math education and guidance. Thirteen women are employed full-time and three on a part-time basis.

Five of the working women are in the teaching field in math and chemistry. The other women are at Martin Marietta, in business for themselves or in a variety of other jobs.

All the women that finished the math review course are planning on continuing their study for a master's degree although only six plan to do so on a full-time basis. Although most of them do not plan to remain in the same job once they complete their MS, most of them have no clear idea of the exact work they plan to do in the future and are very much open for suggestions.

All the women who had signed up for the reentry program but did not take the math review course were also given a questionnaire whose results are shown in Appendix G. Although there were a variety of reasons why some women who had signed up for the program did not take the math review course, for most women it was a lack of calculus. Most are now completing this deficiency. Out of the seventeen questionnaires returned of this type, eleven women plan to apply to the graduate school in the near future. Since the questionnaire was sent out, more women have applied to the program, having heard of it from a friend, or are responding to the publicity.

At the present time (October 30, 1982), forty-nine women have applied to the Reentry Program for Women and most are currently enrolled in classes. Profiles of some of the women in the program follow.

1. Sue Taylor is a 1957 graduate of the University of Michigan and majored in chemistry. After college, she returned to her native New Hampshire area to a marking compounds factory where she was able to utilize her chemistry. In 1960 she married and moved to Orlando. She interviewed for a position as Chemical Librarian, but upon discovering herself pregnant, she decided to stay home and raise her children who are now both in college.

Sue worked as a volunteer while raising her boys, utilizing her math in costume designing, tutoring and teaching. Through her work in ADDitions, a local volunteer organization, she was appointed as the lay member on the committee for the Orange County State Assessment Program three times. Before returning to school, Sue worked for eight years as a clerical aide in a local elementary school. She is now following the Computer Systems option and hopes to eventually be hired as a computer specialist in the Orange County school system.

2. Joni Kast was graduated from the University of Florida in 1978 with a major in statistics. After traveling to Denver she answered an advertisement and became a statistician in the management engineering department of a Denver hospital. Quickly she discovered she did not like Denver, but did enjoy her work and she

returned to Florida to take the same type of job at Orlando Regional Hospital where she is now classified as a staff planner.

Joni wanted to continue her education and considered engineering or business. She chose to pursue the Master of Business Administration since she was convinced she could never cope with the prerequisites for an engineering degree. After getting halfway into her M.B.A., the department decided to offer short condensed courses, which would interfere with her work and at the same time an article appeared in the March 21, 1982, The Orlando Sentinel career section about the reentry program. Since the technical part of her job had interested Joni the most, she is glad she switched into the reentry program. At this time, she is undecided about which option she will pick, but prefers either Systems Analysis or Operations Research. Since her job at the hospital is becoming less technical, she is contemplating changing jobs.

3. Another Florida native, Barbie Lytle, received her degree in math education from UCF in 1972. The next five years she taught mathematics in a middle school in Osceola County, leaving when her first child was born. Her children are now four and two and she has been thinking of a master's degree in mathematics for the past few years. Last December, she saw the presentation on the Carol Nelson show and realized this program was for her.

Barbie plans to graduate by the time her youngest gets to school age and will then look for a full-time or part-time job. She feels she can handle a full-time job better than most women,

since her husband is in education (teaching at UCF) and can be with the children in the summer. She is unsure whether she will pick the Systems Analysis or Operations Research option and equally undecided about which direction she will go after receiving her master's degree.

4. Catherine Lyle, a North Dakota native, grew up in California and graduated from Pomona College in 1969 with a B.A. in chemistry. This was followed by an M.S. in chemistry in 1970 from Tufts University. She taught two years at North California Junior College and moved to the Orlando area in 1972. Since that time, she has been teaching chemistry at Evans High School with two breaks to have children.

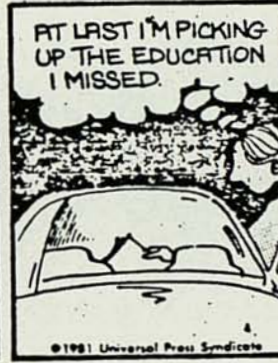
Catherine would like to move out of the teaching field, and since there are no industry chemical jobs in this area and since her skills need refreshing, she plans to get a degree from the College of Engineering. Her plans are uncertain at this point since she has never worked in industry. She is hoping avenues of interest open as she proceeds in her classes. She has enjoyed her operations research course this year since it has shown her some direction to her classes. After next year, her retirement from teaching will be fully vested with the state and she will be able to work more on her degree as well as be with her children who are now five-and-a-half and one-and-a-half.

CHAPTER V

EMPLOYMENT POSSIBILITIES

For many women reentering the academic world is just the first step in the process of finding a new career or redirecting their career. No matter what the women's past experience is, whether out of the work force for many years or in a completely different profession, the same question arises, "Where do I go from here?". In the cartoon below that appeared last year, all these thoughts were pulled together. What does come after the master's degree?

For Better or For Worse



by Lynn Johnston



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Even though the women know that industry is looking for people with their qualifications, there is much unknown about the next step. In talking with some of the professors, they could

not see how the woman's situation is any different than the student receiving the bachelor's degree. The woman who has been in the home or in the teaching field has been isolated from the industrial environment at a time when many changes have taken place. Most of the women that were math majors believed that the only field open to them was teaching. Industrial Engineering, as a discipline, is a complete unknown to these women, and thus, they have no idea of the many types of ways it may be used in a career. In the male-dominated engineering profession, there are few role models for the women, and probably most women are not even aware of those few.

Many women hear that computers are the wave of the future and immediately try to go into the computer science department, where for many of the women with experience in the working world using the computer as a tool in the engineering field, industrial engineering is the best solution.

Knowing that the women are undecided about the future and entering a male-dominated profession, the reentry program has as one of its objectives to familiarize the women with different ways their career may go and thus facilitate their course choices.

A Professional Development Day was held in the middle of July to acquaint all the women registered in the program with some of the career possibilities after receiving the master's degree.

Dr. Whitehouse explained the various options available in the Master of Science program and the differences between them. Other professors of the IEMS Department were there to answer various

questions in a panel discussion. Following this was a discussion of the options available after receiving the M.S. degree. First, the newly formed Ph.D. program was explained.

Mary Sankey, a master's degree candidate, then discussed the way she had approached the master's degree and the job market and handled three small children. Her husband gave her much encouragement as well as Dr. Whitehouse. She used the UCF Placement Service for help with her resume, but did not look to them for employment opportunities. She found that her maturity and being up-to-date in her field were large positives. The atmosphere of handling different work schedules to accommodate mothers is much easier now than several years ago.

Glenda Frazier, a student in the math review course and "engineer" at Martin Marietta explained some of the projects she had worked on while at Martin using only her mathematics background. She felt the need to have engineering training since she is classified as one.

A senior industrial engineer at Walt Disney World, Al Shacklett spoke on industrial engineering in general and at Disney. He felt industrial engineering, more than most careers, was very good for a woman, since they are already used to organizing a home, children, and their own life. He also urged women to participate in the Institute of Industrial Engineers in order to learn more about career opportunities. Industrial engineers are being used more as inflation continues and a manager becomes more cost conscious. Disney

uses their industrial engineering department in order to give guests the best value for their money.

After lunch at the University, most of the women went to NCR for a presentation and plant tour. The presentation, headed by Darrayl Cannon, Director of Manufacturing, related the four options of the master's program to a variety of the jobs in the plant and gave examples on how they could best be used.

In a brief evaluation of the day, the women were very satisfied with the day's activities and had increased their knowledge of the working world from it. They would like to do more of the same.

Many women are interested in reentering the labor force in a part-time or flex-time situation. Although this system has been accepted in the northeast and California, it has not been used in Florida enough to be an accepted way of employment. For this reason, various industries were interviewed in the Orlando area to get their feelings on using the reentry women. For a list of the questions asked, please see Appendix H.

Although the interviewing at different industries will be an on-going project, some interesting discussions have already taken place. Appendix I is a list of the industries that have been and possibly will be interviewed.

Although the overall outlook for women going into local industry is positive, some of the smaller companies are either unable to hire women (or anyone) starting out or they have no desire to

hire women to do work that only men are "interested in". Most of the women in the Reentry Program are not planning to relocate for a job, since their families already live here, thus, they should prepare themselves for the local market. While most of the employers interviewed agreed that the present course options prepared the women well, it was suggested that they also take courses in plant layout and work measurement.

Another suggestion made by industry was to try and increase the women's technical vocabulary. When asked why to increase the women's vocabulary and not the men's, the answer was that no matter how much industry was encouraging women into the engineering field, when they goofed, it was because they were female whereas if a man fell short occasionally, it was more quickly forgiven. Thus, the women needed to be given some advantage.

Along the same lines was the suggestion to increase the technical magazine reading of the women. At this time, a vocabulary list and magazine list is being assembled to give to each of the reentry women.

Even though some women do not like to admit it, the government regulations regarding minority hiring has helped the women's employment outlook. Although there is an advantage sometimes in the hiring, the advantage disappears fast and at the end of five years of employment the advantage is non-existent (McAfee, 1979).

Several companies indicated they are interested in hiring the women for a type of internship, which approximately seven women are

interested in at this time. The drawbacks to that proposal at the present time are the state of the economy, coordination with the personnel department, and lack of minimum courses necessary for an internship. Since internships will complete the learning cycle for the women by the experience of working on real problems, continuing efforts will be made to make internships possible.

Additional engineering manpower needs were predicted to increase ninety-one and a half percent at the master's level over the period from 1979-1984 in the central Florida area (Schrader, 1980), thus, the employment outlook is encouraging. With course options designed to meet the needs of local industry, the reentry women should have excellent employment prospects.

CHAPTER VI

PLACE IN UNIVERSITY FOR PROGRAM

Is there a place at the University of Central Florida for a program like this to continue? At present, this reentry program is designed only for women wishing to obtain the Master of Science degree in the IEMS/EMCS discipline.

As long as women are making the decision to reenter the work force or redirect their careers, an option needs to be available in the engineering field; not only available, but made known to them. Many qualified women are unaware of the opportunities in the industrial engineering field or even what it is.

There needs to be a continuing effort to inform the metropolitan Orlando area of the opportunities in the engineering field. At present, there are no career counseling services on campus for non-students. As a result, women who are still contemplating which career path to follow are sent to other counselors. Once the woman is on campus, there is no general counselor for returning women, as there is on many campuses. The various departments are to handle each situation as it arises. Returning women or returning men are coming in with many different problems and schedules than the typical undergraduate.

Most of the women have been out of school long enough to not know what is available to them in the educational field. Many people in the Orlando area have never been to the UCF campus, and thus, have no idea what is offered there. The special jargon of colleges is different from when they were in school. Application procedures, and especially registration, are forbidding and unknown. Thus, there is a large unknown factor about the future when anyone returns to school after a period of being away.

Until actually becoming involved in the reentry program, women are unaware there are as many reentry women on campus in all fields. When they initially see the student body, all the students appear very young and the reentry women gradually discover others and form their own support groups.

Programs are needed to encourage women into post-baccalaureate engineering programs. This type of program would be geared for the women who have never considered engineering as a career, yet who have a technical background, and women who have postponed graduate study or work for a variety of reasons. Roles and attitudes of women to consider more than the traditional careers in changing and women are becoming more receptive to the engineering field.

Because of economic conditions, the woman's liberation movement, changing thoughts on careers for women, or other reasons more women are coming into engineering and more and more women are re-entering the academic world than before. For this reason, the Women's Reentry Program is needed to facilitate matters during this transition period.

What makes the reentry woman different from the undergraduate woman? Besides the obvious difference of age, the reentry woman has already had real-world experience. Whether the reentry woman is coming out of the home or changing careers or updating themselves, they know what they want in life, or do not want, and the problem is how to get there.

Coming back to school is a serious step for the women, since for them it is a reordering of all priorities. At the beginning of the math review course, the women expressed a lack of confidence in being able to finish the program and were fairly confident that their brain had atrophied. By being together and working out their problems in calculus and life together, their confidence increased and they were able to see the change in themselves. As they are now being mainstreamed, they are regarded as the serious students in each class and have the confidence to ask the questions. They are the highly motivated students who wish to get the most out of each class, rather than take the class just to get the hours in.

Some returning women have gone to professors (ones not involved in the reentry program) and have felt that he did not know what to do with her. After actively seeking advice on a major life decision, they were bounced from one advisor to another. Only on their own determination did they finally enroll, never sure of whether what they were doing was right and wondering if there were any other women in the same boat. On the other hand, the women who came together

as complete strangers in the math review class left as a supportive group. As they have been mainstreamed, they are continuing their support for each other.

While mainstreaming the women as we do at UCF is different from the University of Dayton's program and Boston University's fast track program, mainstreaming seems to suit a commuter college such as UCF. This also allows a greater freedom of options for the women and the ability to fit in more or less courses as one's time schedule allows. Because of mainstreaming, it is more important for the women to have some type of support group.

Another idea which has been advanced by Carol Shaw of the University of Dayton in support of establishing reentry programs is that a young woman would not be hesitant to take time out from her technological career to raise her family if she knew that when the time came for her to return to work, she could be up-dated and her fear of obsolescence would disappear. This would allow her to strengthen her family ties (Shaw, 1980).

For the women's needs, a reentry program is desirable. The university benefits also, since more students are being attracted to the university at the graduate level. This year, fifteen percent of the graduate students are women compared to a nation-wide total of seven percent of women receiving master's level degrees in Engineering last year. This program demonstrates a commitment to today's woman, while increasing the total percentage of women graduate students in the College of Engineering.

CHAPTER VII

CONCLUSIONS

The number of women enrolled in the graduate school in the College of Engineering has grown to forty-eight, a fifty percent increase from last year's enrollment. To continue this momentum efforts need to be maintained to attract the qualified student. The community and industrial relationships with the University are also strengthened by the program. This is done by continuous presentation to the community and cooperation with the local industries. The publication of the November, 1982 issue of Working Woman, a nationally distributed magazine for women, has given the reentry program at UCF nationwide publicity. This article has resulted in inquiries from across the country.

With the momentum which has built up in the past year and the encouragement given by the IEMS/EMCS faculty and the local industries, the Reentry Program for Women should be continued with the following recommendations:

1. Continue the University's support of the reentry program and its efforts to find grants to help support the program and scholarships for qualified women.

2. Continue the math review course in the same format as before with two classes of two hours each per week, preceded by a

homework tutoring session. Have the tapes also accessible in the library.

3. Use the same math review book - Analytic Geometry and Calculus. The only problem foreseen here is the text will not be reprinted and the supply is running low.

4. Continue media publicity, with emphasis on obtaining a space in the Career Section of The Orlando Sentinel in the spring.

5. Provide another Professional Development Day in the summer of 1983.

6. Use the special application form with additions of GRE score, listings of all college math courses taken, and programming experience.

7. Provide internships for graduate students to give them practical experience along with their academic work.

8. Continue with the Industrial Advisory Board and update its members periodically and have a meeting during the next year.

9. Continue with offering some prerequisite courses in the evening.

10. Develop a technical glossary for the reentry women.

11. Offer more seminars in special skills as assertiveness training, time management, and communication.

12. Encourage qualified women to take mathematics in college in order to keep their future options open.

13. Inform all the College of Engineering faculty of the program.

14. Expand the Reentry Program for Women from the Industrial Engineering and Management Systems Department to the entire College of Engineering.

APPENDICES

APPENDIX A

WINNERS OF MINI-GRANTS AND TYPE OF PROGRAM - SUMMER 1981

<u>Institution</u>	<u>Program</u>
Bloomfield College	Biochemistry
Byrn Mawr College	Management
Fordham University	Chemistry
Rhode Island College	Computer Programming
St. Francis College	Accounting
Ball State University	Data Processing
Catholic University of Puerto Rico	Chemistry
University of New Mexico	Computer Science or Electronics
Southern University	The Technical Fields
Texas Women's University	Chemistry or Programming overcoming Math
West Virginia University	Anxiety
Evergreen State College	Change Careers
University of Nevada	Computer Programming
New England College	Computer Science
Weber State College	Engineering Technology
Wichita State University	Engineering and Computer Science

APPENDIX B

INDUSTRIAL ADVISORY BOARD

Mr. Don Barnhart
Program Manager for Business
Systems
Data Systems Division
Martin Marietta

Mr. Darrayl Cannon
Director of Manufacturing
NCR

Mrs. Dorothy Lemmon
Educational Representative
Southern Bell

Mr. Morris Middleton
Training Analysis Evaluation
Group
Naval Training Center

Mr. Roger Pynn
Manager, Community Relations
Westinghouse

Mr. Robert R. Radula
Director of Production Engi-
neering
Martin Marietta

Mr. Al Shacklett
Industrial Engineers
Walt Disney World

Mr. William Smothers
International Lasar Systems

Dean Bruce E. Mathews
Assistant Dean of Engineering
College of Engineering
University of Central Florida

Dr. Gary E. Whitehouse
Chairman
Department of Industrial Engi-
neering and Management Systems
University of Central Florida

Dr. Harold I. Klee
Associate Professor of Engineer-
ing
Department of Industrial Engi-
neering and Management Systems
University of Central Florida

Dr. Carol P. Wilson
Associate Dean, Student Services
University of Central Florida

Dr. Marilyn Whisler
Associate Professor of Political
Science
University of Central Florida


Mrs. Lucy Morse
Project Director

APPENDIX C

FACSIMILE OF BROCHURE OF REENTRY PROGRAM FOR WOMEN

WOMEN:
Interested In
Engineering?

**REDIRECT
YOUR
CAREER**

**UPGRADE
YOUR
EDUCATION**

Are you a woman at an important crossroad in your working life? Perhaps you are reentering the work force after a lapse of time, or thinking of changing from a career that no longer satisfies you. Perhaps you are ready to develop your present job into a more challenging position.

If you have a Bachelor's degree in mathematics, physics, engineering or some other hard science, your career opportunities could be enhanced by an engineering background.

The University of Central Florida Reentry Program opens the door to you for personal growth.

REENTRY PROGRAM OBJECTIVE

The University of Central Florida's College of Engineering Reentry Program for Women is designed to encourage women to enter graduate school in the engineering field. Master of Science degrees are offered by the Industrial Engineering and Management Systems Department and the Engineering Mathematics and Computer Systems Program. The degree options include Operations Research, Engineering Administration, Computer Systems, and Engineering Systems Analysis. In addition, other Master's degree programs are available.

WHY ENGINEERING NOW?

Engineering has been a predominantly male profession, but now it is opening up for women. Over 50 percent of all job offers to college graduates in the last four years have gone to students with engineering degrees; and upper level management positions are increasingly going to people with engineering backgrounds. A 29 percent increase over last year is expected at the Master's level next year.

Many foreign and domestic high technology firms are opening new plants across Central Florida. These national trends within Central Florida provide excellent career opportunities for you.

WHAT IS THE REENTRY PROGRAM?

The primary component of the program is a specially designed math review course. Reentering students often experience difficulties in a graduate program because the basic mathematical tools needed as a prerequisite tend to be forgotten.

A comprehensive review of college algebra, trigonometry, analytical geometry, calculus and an introduction to differential equations will be offered.

Career counseling and job placement are an integral part of UCF's reentry program. Individual counseling and training in resume writing and job interview skills are available to each participant. The program also will include peer support and information addressed to the reentry woman's special needs.

WHEN IS THE MATH REVIEW COURSE OFFERED?

The Math Review Course will be offered in a short summer session, May 10 through June 18, 1982.

WHO IS ELIGIBLE?

Women who received a Bachelor's Degree at least two years ago are eligible for the program. The degree must have been in mathematics, engineering, physics, or another hard science.

MASTER OF SCIENCE DEGREE OPTIONS

Engineering Administration:

The Engineering Administration option provides the opportunity for in depth study of new technical developments in the College of Engineering augmented by study of new administrative and management concepts in the College of Business Administration. The basic program is designed for persons with technical backgrounds who are seeking to advance into management in a technically oriented firm. This option prepares the student with the basic techniques required to manage people, develop the ability to use analytical tools, and apply decision-making techniques to technical and business problems.

Engineering Systems Analysis:

In a society which is producing more people, more materials, more information than ever before, the analysis of complex systems and equipment requires talented individuals who are especially trained in the application of mathematics and the use of computer systems. Some of the tools of Systems Analysis are modeling, optimization, control, computing, and reliability; they are available to solve the engineering and scientific problems of today in a systematic approach. Virtually all disciplines are amenable to the Systems Engineer, ranging from the dynamics of reentry vehicle guidance systems to the response of local health care systems.

Operations Research:

Operations Research is the application of computer and quantitative models to the decision problems of business which include hospitals, banking and social services. The role of Operations Research is to help management find the overall optimum solution for problems involving interactions of objectives. Operations Research tries to find the best decisions relative to as large a portion of the total system as possible.

Computer Systems:

In contemporary professional engineering practice and in manufacturing, research and development activities, there is an increasing need for engineers and technical support staff with training and capability in the application of mathematics and computers to the modeling, simulation and solution of complex technical problems. This option area provides the student with an appropriate educational experience to facilitate employment in a wide variety of computer-related fields. Course coverage includes computer hardware, software engineering, and microcomputers. Depending on the student's interests, computer graphics or other similar advanced areas are available as technical electives.

APPLICATION DEADLINE:

Applications should be returned by:
March 15, 1982.

Late applications will be considered if openings exist.

HOW TO APPLY?

For a special application, contact:
Lucy Morse or Dr. Gary Whitehouse
IEMS/EMCS Department
University of Central Florida
Orlando, FL 32816
OR CALL: (305) 275-2236

APPENDIX D

MASTER OF SCIENCE COURSE OPTIONS

UNIVERSITY OF CENTRAL FLORIDA

College of Engineering

MS Graduate Program in ENGINEERING ADMINISTRATION (effective Fall 1981)

The Department of Industrial Engineering and Management Systems offers a Master of Science (M.S.) degree for students who have an undergraduate degree in Engineering, Mathematics or Science. This degree requires 30 semester hours of approved graduate work. The degree requires either a Research Report (3 semester hours) or a Thesis (6 semester hours) within the 30 semester hours. An individual program of study is developed with a Faculty Advisor but must conform to the following guidelines:

Prerequisites

Engineering Economic Analysis
 Operations Research
 Mathematics through Differential Equations
 Probability and Statistics
 FORTRAN Programming

Required Courses

EIN 6357	Advanced Engineering Economic Analysis	(3)
STA 5156	Probability and Statistical Methods for Engineering	(4)
EIN 6140	Project Engineering	(3)

Technical Electives

ESI 6316	Operations Research	(4)
ACC 5004	Financial Accounting Concepts	(3)
EIN 6305	Engineering Administration II	(3)
ECM 6416	System Simulation	(3)
EIN 5117	Management Information Systems	(3)
ESI 6525	Systems Dynamics	(3)
ESI 4234	Engineering Reliability and Quality Assurance	(3)
EIN 6215	Systems Safety	(3)
EVN 4251	Automation	(3)
ECP 6205	Labor Economics	(3)
ECP 6405	Industrial Organization and Performance	(3)
MAN 5051	Management Concepts	(2)
MAN 6055	Planning and Control	(3)
MAN 6121	Group Decisions and Analysis	(3)

MAN 6206	Organizational Behavior and Development	(3)
FIN 5405	Financial Concepts	(3)
FIN 6406	Financial Analysis and Management	(3)
ECO 5055	Economic Concepts	(3)
ACC 6734	Accounting Analysis	(3)
ECP 6704	Managerial Economics	(3)
ECO 6111	Economic Analysis of the Firm	(3)

Thesis or Research Report

3 to 6 hrs

Additional sub-discipline specialty courses are selected within the M.S. requirements of the College of Engineering and often include appropriate support courses to meet the individual needs for each student. The State University System of Florida requires that each student take the Graduate Record Examination (GRE - aptitude section only) prior to being admitted as a regular graduate student.

UNIVERSITY OF CENTRAL FLORIDA

College of Engineering

MS Graduate Program in OPERATIONS RESEARCH (effective Fall 1981)

The Department of Industrial Engineering and Management Systems offers a Master of Science (M.S.) degree for students who have an undergraduate degree in Engineering, Mathematics or Science. This degree requires 30 semester hours of approved graduate work. The degree requires either a Research Report (3 semester hours) or a Thesis (6 semester hours) within the 30 semester hours. An individual program of study is developed with the Faculty Advisor but must conform to the following guidelines:

Prerequisites

Engineering Economic Analysis
 Operations Research
 Mathematics through Differential Equations
 Probability and Statistics
 FORTRAN Programming

Required Courses

STA 5616	Probability and Statistics for Engineers	(4)
ECM 6416	Discrete Systems Simulation	(4)
ECM 5135	Engineering Math Analysis I	(3)

Restricted Electives (choose at least 3 courses)

ECM 6235	Engineering Math Analysis II	(3)
ESI 6336	Queueing Systems	(3)
ESI 6427	Mathematical Programming I	(4)
ESI 6437	Mathematical Programming II	(4)
EIN 6337	Production and Inventory Control	(3)
ECM 6417	Advanced Systems Simulation	(3)

Thesis or Research Report

3 to 6 hrs

Additional sub-discipline specialty courses are selected within the M.S. requirements of the College of Engineering and often include appropriate support courses to meet the individual needs for each student. The State University System of Florida requires that each student take the Graduate Record Examination (GRE - aptitude section only) prior to being admitted as a regular graduate student.

UNIVERSITY OF CENTRAL FLORIDA

College of Engineering

MS Graduate Program in ENGINEERING SYSTEMS ANALYSIS (Effective Fall 1981)

The Department of Engineering Mathematics and Computer Systems offers a Master of Science (M.S.) degree for students who have an undergraduate degree in Engineering, Mathematics or Science. This degree requires 30 semester hours of approved graduate work. The degree requires either a Research Report (3 semester hours) or a Thesis (6 semester hours) within the 30 semester hours. An individual program of study is developed with a Faculty Advisor and is required to conform to the following guidelines.

Prerequisites

Operations Research
 Mathematics through Differential Equations
 Probability and Statistics
 FORTRAN Programming
 Systems Analysis

Required Courses

ECM 5135	Engineering Math Analysis I	(3)
ECM 6235	Engineering Math Analysis II	(3)
ECM 6416	Discrete Systems Simulation	(4)
ESI 6316	Operations Research	(4)

Restricted Technical Electives (choose at least 2 courses)

ESI 6525	Systems Dynamics	(3)
ESI 5575	Mathematical Systems Theory	(3)
EIN 5117	Management Information Systems	(3)
ECM 6426	Continuous System Simulation	(3)
ECM 6417	Advanced Systems Simulation	(3)
STA 5156	Probability and Statistics for Engineers	(4)

Research Report or Thesis

3 to 6 hrs

Additional sub-discipline specialty courses are selected with the M.S. requirements of the College of Engineering and often include appropriate support courses to meet the individual professional needs for each student. The State University System of Florida also requires that each student take the Graduate Record Examination (GRE - aptitude section only) prior to being admitted as a regular graduate student.

UNIVERSITY OF CENTRAL FLORIDA

College of Engineering

MS Graduate Program in COMPUTER SYSTEMS (effective Fall 1981)

The Department of Engineering Mathematics and Computer Systems offers a Master of Science (M.S.) degree for students who have an undergraduate degree in Engineering, Mathematics or Science. This degree requires 30 semester hours of approved graduate work. The degree requires either a Research Report (3 semester hours) or a Thesis (6 semester hours) within the 30 semester hours. An individual program of study is developed with a Faculty Advisor and is required to conform to the following guidelines:

Prerequisites

Mathematics through Differential Equations
 Assembly Language Programming
 Probability and Statistics
 FORTRAN Programming
 Digital Logic Circuits

Required Courses

EEL 5365	Introduction to Digital Systems	(3)
EEL 6349	Computer Systems Design	(3)
ECM 5505	Micro Computer Systems	(3)
ECM 5806	Software Engineering I	(3)

Restricted Electives (select 3 courses)

ECM 5506	Engineering Applications of Computer Graphics	(3)
ECM 6706	Engineering Data Reduction	(3)
ECM 6805	Microcomputer Applications Design	(3)
ECM 6807	Software Engineering II	(3)
EEL 6717	Digital Computer Systems	(3)
EIN 6258	Man-Computer Interaction	(3)

Research Report or Thesis

3 to 6 hrs

Additional sub-discipline specialty courses are selected within the M.S. requirements of the College of Engineering and often include appropriate support courses to meet the individual needs of each student. The State University System of Florida also requires that each student take the Graduate Record Examination (GRE - aptitude section only) prior to being admitted as a regular graduate student.

APPENDIX E

FACSIMILE OF PRELIMINARY APPLICATION FOR
REENTRY PROGRAM FOR WOMEN

PRELIMINARY APPLICATION FOR REENTRY PROGRAM FOR WOMEN

1. Name _____
first middle or maiden last or family

2. Social Security Number _____

3. Address _____
number and street city and state zip

4. Telephone _____
area code number

5. I am a U.S. Citizen _____ Or, Citizen of _____
country

I was born in _____
country

6.	COLLEGE	LOCATED	FROM	TO	MAJOR	DEGREE/YR.

8. *Previous Employment, starting with most recent position.*

		FROM	TO
<i>position held</i>	<i>employing firm</i>	<i>mo. / yr.</i>	<i>mo. / yr.</i>
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

9. Please comment briefly on the following questions:

a) What are your reasons for applying to this program?

b) How did you hear of this program?

The Math Review course is scheduled to begin Monday, May 10 and will last six weeks. This course will meet 8 hours per week. Hours will be arranged to try to accommodate the participant's schedule.

APPENDIX F

PROFILE OF WOMEN IN MATH REVIEW CLASS* REENTRY PROGRAM FOR WOMEN

Marital Status: Married 15
Single 4
Divorced 0

Age: (20-30) 6 (40-50) 3
(30-40) 9 (50-70) 1

Husband Engineer: 6

Women with Children: 9
Ages: (0-3) 3 (14-18) 1
(4-13) 7 (19-) 6

Bachelor's Degrees:
Math - 7 Statistics - 1 Computer Science - 1
English - 2 Chemistry - 5 Math Education - 1
Education - 1 General Studies - 1 Engineering Technology - 1
Sociology/Anthropology - 1

Degree from Florida Colleges: 11

Master's Degrees: 3
Math Education
Chemistry
Guidance

Presently Employed: 13
Part-time: 2

Current Teachers: 5
Math - 3.5
Chemistry - 1.5

Past and Current Teachers: 11
Years in Teaching: (0-5) 3 (5-10) 4 (10-20) 3 (20-) 1

Interested in (pursuing) M.S. in Engineering: 18

Full-time Study: 3

Have not taken Differential Equations: 8

Plan to Remain in same job after completing M.S.: No - 10
Undecided - 4

Do not have definite career path: 6

* 19 questionnaires returned

APPENDIX G

PROFILE OF WOMEN NOT IN CLASS* REENTRY PROGRAM FOR WOMEN

Reason for not taking class:

Applied too late	- 2
Too little calculus	- 8
Not necessary	- 2
Other	- 5

Plan to take course in future: 4

Plan to enter Master of Science program in Engineering: 11

Full-time study: 2

Presently employed: 15

Currently teaching: 1 (Math)

* 17 questionnaires returned

APPENDIX H

QUESTIONS FOR INDUSTRY

1. How does business feel about a Master of Science degree from a college of engineering, and a bachelor's degree in unrelated field?
2. Would it be better for a woman to obtain a second bachelor's degree in engineering or a Master of Science degree?
3. Are you interested in supporting any women in a part-time internship?
4. Are you familiar with the concepts of flex-time or time-sharing? Would you be interested in hiring women under these terms after they graduate?
5. Does a person in engineering field have to be a P.E. before being considered for advancement?
6. What are some of the types of jobs open to women with M.S. degree and one of the four options: operations research, engineering administration, computer systems, or engineering systems analysis?
7. How do you foresee your engineering employment situation in the next three to five years?

APPENDIX I
NAMES OF INDUSTRIES

<u>Name of Industry</u>	<u>Location</u>
Applied Devices	Kissimmee
Documentation	Melbourne
Educational Computer Corporation	Orlando
Emerson Electric Company	Casselberry
General Electric	Daytona Beach
Harris Corporation	Melbourne
International Laser Systems	Orlando
ITT North Electric	Cape Canaveral
Martin Marietta	Orlando
McDonnell Douglas	Titusville
Navy Base	Orlando
NCR	Lake Mary
Piezo Technology	Orlando
Repco	Orlando
Rush Hampton Industries	Longwood
Stromberg Carlson	Sanford
Walt Disney World	Lake Buena Vista
Westinghouse	Orlando

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